

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 033

Rotating Machine Package Specification Air Compressor and Air Dryer
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1. Scope

1.1 Purpose

This specification relates to the packaging of the Air Compressor and Air Dryer Packages and specifies the minimum design and construction requirements for the equipment that make the package. It is an exhaustive document detailing the scope of supply and the associated design rules requested by TOTAL E&P for the procurement of Air Compressor and Air Dryer Packages.

1.2 Application

This document applies to the design of all Oil Free Rotary Air Compressor and Air Dryer packages. It excludes any other type of air compressor.

1.3 General rules

All deviations from this specification or the documents referred to herein shall be stated in writing in the Appendix 6 of this specification. In the absence of such a statement, it is assumed that the requirements of the specifications are met without exception. Failure to meet the requirements of this specification and referenced documents shall be corrected at Supplier's cost. Exceptions and deviations to the specifications shall be part of Supplier's proposal and will be subject to Company approval.

Where this specification, or any other project document, allows the Supplier to propose an "option", the Supplier shall clearly state the selected option in his bid.

In cases the Supplier provides outsourced equipment, he shall be responsible for the coordination of the Sub-Suppliers, and ensuring the full compatibility of all the equipment. In particular, they shall be compatible in terms of safety, environment, operability, dimensions, weight, performance, control, noise and vibration behavior.

Components not mentioned in this specification that are necessary for the operation of the equipment or required by certifying agency, regulatory bodies or by law, shall be Supplier standard components.

The present document remains a General Specification as long as the modifiable forms are not completed. It becomes the Project Specification once these modifiable forms are completed and shall therefore not be considered as a General Specification any more.

Then, the General Specification shall be attributed a Project reference number with the associated Project front page.

Preamble shall be completed with the Project description (location, number of machines, etc.).

If Project specificities require amendments to non modifiable parts of this specification or to the documents referred to herein, they shall be considered as deviations and stated in writing in the Appendix 6 of this specification.

This specification will then be issued in two steps:

- Issued "for inquiry"
- Issued "for purchase".

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The applicable documents shall be considered in the following order:

- Local regulations
- Classification Society Rules (If applicable)
- Frame agreement if available
- This completed specification and associated data sheets
- Referenced General Specifications
- Referenced Project specifications
- Codes and standards.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
1999/92/EEC (ATEX 118 ¹ /ATEX 137 ²)	European Directive 1999/92/EEC (16/12/99) on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres
94/9/EC (ATEX 100a ¹ /ATEX 95 ²)	European Directive 94/9/EC (23/03/94) on the approximation of the laws of the Member State concerning equipment and protective systems intended for use in potentially explosive atmosphere
ANSI/ISA-7.0.01	Quality standard for Instrument Air
API Std 672	Packaged, Integrally Geared Centrifugal Air Compressors for Petroleum, Chemical, and Gas Industry Services
DIN 55473	Auxiliary means of packaging - Desiccant in bag - Technical delivery conditions
IP 15	Area Classification Code for Petroleum Installation handling flammable fluids - July 2005 (3 rd edition)
ISO 10816-3	Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts - Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15 000 r/min when measured in situ
ISO 1217	Displacement compressor - Acceptance Tests

¹ Reference to Articles 100/118 of the Treaty of Rome

² Reference to Articles 95/137 of the Treaty of Amsterdam

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Reference	Title
ISO 5167	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full
ISO 780	Packaging. Pictorial marking for handling of goods
ISO 8573-1	Compressed air - Part 1: Contaminants and purity classes
NF H00-310	Industrial packagings. Flexible and heat sealing protection materials of low coefficient of water vapour transmission ($P < 0.3 \text{ g/m}^2 \text{ 24 h}$)
NF H00-320	Packaging. Desiccant. Specifications and tests
US MIL-STD-2073-1 E	Standard Practice for Military Packaging
US MIL D 3464E	Desiccants, activated, bagged, packaging use and static dehumidification
US MIL PRF 131K	Performance Specification Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat- Sealable.

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

TOTAL EP General Specification Referential is applicable for the following Project:

The following Company specifications are fully applicable to all purchased equipment as listed in paragraph 3.1 completed by the technical details reported in paragraph 4 and taken into account accepted deviations as listed in Appendix 6. The second level General Specifications mentioned in each individual specification are not applicable if they are not listed in the below tables. The standards, professional documents, regulations and codes mentioned in each General Specification are applicable.

The following list may also be complemented with other specific Project detailed specifications which would include additional requirements, as applicable or deemed necessary by Company or Contractor.

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 354	External protection of onshore structures and equipment by Painting
GS EP COR 356	Corrosion Protection of Fasteners for Subsea and Topsides Applications
GS EP ELE 011	Electrical requirements for packaged units

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Reference	Title
GS EP ELE 031	Design of earthing and bonding systems
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP ELE 111	Induction motors
GS EP ELE 161	Electrical cables
GS EP EXP 217	Requirements to Vendors, Suppliers and EPC`S for spare parts
GS EP INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 102	Instrumentation identification
GS EP INS 104	Design of generation and distribution of instrument air or gas
GS EP INS 107	Design and installation of instrumentation links
GS EP INS 110	Instrumentation for package units
GS EP INS 135	Cyber Security requirements for design and supply of ICSS and Package Systems
GS EP MEC 101	Driver Power Sizing
GS EP MEC 292	Rotating Machines Packages Installation Requirements
GS EP MEC 300	Noise and Vibration of Rotating Machine Packages
GS EP PVV 112	Piping material class
GS EP PVV 143	Metallic pipes
GS EP PVV 144	Fittings
GS EP PVV 145	Flanges
GS EP PVV 175	Cleaning of piping and vessels
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP STR 001	Weight monitoring and weighing offshore units
GS EP STR 103	Design and fabrication of skids and equipment supporting structures

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In case one of the previous General Specifications is completed with one or more Project specific detailed specification(s), then these detailed specifications (and their respective revision) shall be added to the following list.

Project Documents (to be completed by Company or Contractor)

	Designation	Rev	Reference
1	PID's (*)		
2	Layout (*)		
3	Project specification for electrical requirements for packaged units (*)		
4	Instrument tagging specification (*)		
5	Instrument list database specification (*)		

Note: All the documents identified by (*) shall be available along with this specification for the issue for inquiry and for purchase.

Project data sheets are listed in paragraph 5.

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3. Scope of supply and exclusions

3.1 Scope of supply

The Vendor shall be responsible for the design, supply of materials, manufacture, assembly, supply of drawings and data, all Sub-Vendor co-ordination, testing, delivery and guarantees of the below components:

Note 1: The column "Required" indicates the level of requirement of each item, according to the below rule:

- "X" means that the item is a base case requirement.

-  means that the item is an optional requirement specific to the project. "Y" for YES if the option is selected or "N" for NO if the option is not selected.

Note 2: The column "Description" may offer alternative technical choices that shall be fixed prior to the issue "For inquiry" by ticking the appropriate mark box .

#	Item	Description	Required	Tag	Quantity
1	ON SKID EQUIPMENT				
1.1	Air compressor package including but not limited to:				
1.1.1	Dry (oil free) air compressor	As per data sheet enclosed in paragraph 5 of this specification. ☐ 2x100% duty ☐ 3x50% duty	X		
1.1.2	Inter stage and after coolers	As per paragraph 4.5.3 of this specification.	X		
1.1.3	Moisture separators and drains	As per paragraph 4.5.4 of this specification.	X		
1.1.4	Lube oil system	Common self contained lube oil system.	X		
1.1.5	On-skid local gauge board	As per paragraph 4.12.6 of this specification.	X		
1.1.6	Air intake filter system	As per paragraph 4.5.1 of this specification.	X		
1.1.7	Inlet & Outlet silencers	As per paragraph 4.14.2 of this specification.	X		
1.1.8	Vibration sensors	As per paragraph 4.12.3 of this specification.	X		
1.2	Main electric motor including but not limited to:				
1.2.1	Main electric motor	As per GS EP ELE 111 and as per data sheet referenced in paragraph 5 of this specification.	X		
1.2.2	Cable glands	As defined in the data sheet referenced in paragraph 5 of this specification.	X		
1.2.3	Vibration and temperature monitoring	As per GS EP ELE 111 and as per data sheet referenced in paragraph 5 of this specification.	X		set
1.2.4	All associated instrumentation and auxiliary junction boxes		X		set

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#	Item	Description	Required	Tag	Quantity
1.3	Base plate including but not limited to:				
1.3.1	Fabricated steel common base plate	As per paragraph 4.7.2 of this specification.	X		
1.4					
1.4.1	2 x 100% Pre-filters	As per paragraph 4.5.5 of this specification.	X		
1.4.2	One set of twin heatless adsorption type air dryer	As per paragraph 4.5.6 of this specification.	X		
1.4.3	2 x 100 % after-filters	As per paragraph 4.5.7 of this specification.	X		
1.4.4	On / Off automatic valves (ROV)	As per paragraph 4.5.5 of this specification.	X		
1.4.5	Manual isolation valves	As per Appendix 2 of this specification.	X		
1.4.6	Safety relief valves	As per paragraph 4.12.2 of this specification.	X		
1.4.7	On skid local gauge board	As per paragraph 4.12.6 of this specification.	X		
1.4.8	Fabricated steel common base plate	As per paragraph 4.7.2 of this specification and as per GS EP STR 103 .	X		
1.5	Power transmission equipment including but not limited to:				
1.5.1	Gearbox	If required.	X		
1.5.2	Semi flexible coupling	As per paragraph 4.6 of this specification.	X		
1.5.3	Rigid coupling guard	As per paragraph 4.6 of this specification.	X		
1.6	Enclosure including but not limited to:				
1.6.1	Acoustic Enclosure	As per paragraph 4.8 of this specification.	X		
1.6.2	Air Ventilation System	As per paragraph 4.8.1 of this specification.	X		sets
1.7	Control and instrumentation including but not limited to:				
1.7.1	Junction boxes	All necessary instrumentation junction boxes at skid edges as per GS EP INS 101 and GS EP INS 107 .	X		sets
1.7.2	Cable glands	Cable glands for departing multi-core cables, defined by Project and blinded off suitably for transport and storage. In case the option is not selected, the gland plates shall be pre-drilled and blinded off.	Option		sets
		For all other cables, junction boxes shall be provided with cable gland plates and associated cable glands.	X		
1.7.3	Instrumentation cables	All instruments cables between Instruments and skid mounted terminal Junction boxes / local gauge board as per GS EP ELE 161 and GS EP INS 107 .	X		sets
1.7.4	Instruments cables trays	All necessary cables trays with covers made of AISI 316L between instruments and skid mounted junction boxes as per GS EP INS 107 . Empty cable trays for the multi-core cables (supplied and installed by other) between the terminal junction boxes and skid edge.	X		sets

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#	Item	Description	Required	Tag	Quantity
1.8	Electrical including but not limited to:				
1.8.1	Electrical cables trays	All necessary cables trays with covers made of AISI 316L between all electrical consumers mounted on skid and the skid edge.	X		sets
2	OFF SKID EQUIPMENT (Shipped Loose)				
2.1	UCP	UCP including PLC for control/safety, panel mounted HMI. As per GS EP INS 110 and paragraph 4.12.4 of this specification.	X		
2.2	ICSS interface	Communication cards, relays, signal convertors, etc. to interface with ICSS and support systems (if any).	X		sets
2.3	VTMS	Vibration and Temperature Monitoring System to control the complete shaft line vibration and temperature sensors integrated inside UCP.	Option		sets
2.4	Soft starter for main electric motor	As per motor data sheet referenced in paragraph 5 of this specification.	Option		
2.5	Dew point analyzer	Moisture monitoring/ dew point analyzer as per paragraph 4.15.1 of this specification.	Option		
2.6	Wet air receiver	As per paragraph 4.15.2 of this specification.	Option		
2.7	Dry air receiver	As per paragraph 4.15.2 of this specification.	Option		
2.8	Interconnecting piping	Interconnecting piping between all air compressor skids.	Option		sets
2.9	Interconnecting piping	Interconnecting piping between air compressor skid and air dryers skid.	Option		sets
2.10	Special tools	Refer to paragraph 8.2 of this specification.	X		
2.11	Spare parts for commissioning and start-up	Refer to paragraph 8.1.1 of this specification.	X		
2.12	Capital spare parts	Refer to paragraph 8.1.2 of this specification.	X		
3	MISCELLANEOUS				
3.1	Baseplate anchor bolts and shims	As per Appendix 3.	X		sets
3.2	Off skid equipment anchors and shims	All anchors and shims for all off skid equipment supplied by SUPPLIER.	X		
3.3	Lifting tools for the complete package	Consists of slings, shackles and spreader bar as per paragraph 4.7.4 of this specification and as per GS EP STR 103 .	X		
3.4	Limit flanges	All limit flanges as per GS EP PVV 112 or Project piping classes -if available- equipped with blind flanges for transportation.	X		
3.5	Maintenance laptop	Including software for UCP configuration.	X		
3.6	Backup	Complete backup hard disk with application software, PLC program, HMI and any firmware prior to shipment.	X		sets
3.7	Software	OEM CD/DVD for any software used with full licenses.	X		sets
3.8	Documentation	Set of documents as per Appendix 4 of this specification.	X		

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#	Item	Description	Required	Tag	Quantity
3.9	Earthing network	Earthing design and implementation as per GS EP ELE 031 and GS EP INS 107 .	X		sets
3.10	Package preservation	As per paragraph 9.1 of this specification.	X		
3.11	Painting	As per paragraph 4.13 of this specification.	X		sets
3.12	Specific climate considerations	☐ Tropicalization ☐ Winterization ☐ None	X		
4	TESTS				
4.1	Factory tests				
4.1.1	Main electric motor	As per paragraph 7 of GS EP ELE 111 and data sheet referenced in paragraph 5 of this specification.	X		
4.1.2	Air compressor package	As per ISO 1217 and paragraph 7.1 of this specification.	X		
4.1.3	Air dryers	As per paragraph 7.1 of this specification.	X		
4.1.4	UCP	UCP integration and communication test at Sub-Vendor premise as per paragraph 7.1.4 of this specification and paragraph 7.4 and Appendix 5 of GS EP INS 110 .	X		
4.1.5	Air compressor and air dryers package complete unit tests	As per paragraph 7.1.3 of this specification.	X		
4.1.6	Noise and vibration test	As per paragraph 7.1.3 of this specification.	X		
4.2	Site acceptance tests				
4.2.1	Air compressor and air dryers package complete unit tests	As per paragraph 7.2 of this specification.	X		

Vendor shall be responsible for the physical and technical compatibility of the entire package and shall ensure that all equipment and components provided are suitable for the operations intended.

3.2 Exclusions

The following equipments are not included in the scope of supply:

- Counter flanges, gaskets and bolting for connecting flanges at battery limits of Vendor's supply
- All piping outside the package
- Electric and instrument cables outside the package
- All earthing cables outside the package.

4. Basis of design

This paragraph details the technical specificities of Project that are not covered in the Company General Specifications nor in the Project documents.

4.1 General considerations / safety and environment

The complete package shall be designed for years of operation.

Environmental conditions for the equipment design are indicated in the paragraph 6 of this specification.

When packages have to be installed in hazardous area zone 2, as per [IP 15](#), they shall be specified for gas group IIA and temperature class T3 (200°C) and [ATEX European directives 94/9/EC](#) and [1999/92/EEC](#) shall be applied.

In this case, packages shall be certified ATEX **Ex** II 3G and CE marked with the following requirements:

- Any instrumentation component shall be certified ATEX **Ex** II 2G and CE marked. For facilities located outside the European Union (EU countries), alternative IECEx scheme can be applied (IEC Scheme for Certification relating to Equipment for use in Explosive Atmospheres)
- Any electrical component shall be selected in accordance with [GS EP ELE 079](#)
- Any mechanical component certified ATEX **Ex** II 3G and CE marked.

Any equipment or system required to be left in operation when a safe or a hazardous area zone 2 becomes a hazardous area zone 1 (such as presence of gas, ventilation failure, etc.) shall be certified ATEX **Ex** II 2G and CE marked.

Package and all accessories shall bear their own marking, according to the mode of protection used.

The UCP, located in the Instrument Technical Room, will be designed for a non hazardous area.

When packages are installed in non hazardous area, electrical and instrumentation devices shall be certified by Notified Body as suitable for use in a hazardous area and shall comply with the [European 94/9/EC](#) (ATEX 100a / ATEX 95) and the [1999/92/EEC](#) (ATEX 118 / ATEX 137).

Any electrical component shall be certified in accordance with [GS EP ELE 079](#).

Packages and all their auxiliaries may be ATEX self certified by the air compressor and air dryer packages Supplier.

4.2 Architecture

Refer to Air compressor package schematic attached in Appendix 2.

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4.3 Instrument air quality

The quality of the instrument air at the outlet of the air drum shall be in accordance with [ANSI/ISA-7.0.01](#) - Section 5, amended as follows:

- Temperature dew point as per [GS EP INS 104](#)
- Particle size as per paragraph 4.5.7 of this specification and [ISO 8573-1](#) Quality Class 0
- Oil free as per [ISO 8573-1](#) Quality Class 0 requirement.

4.4 Operating conditions

Each compressor shall have devices for Normal and Automatic start up in case of failure of the other(s).

In normal condition, instrument and service air flow shall be supplied by the main compressor(s) in service. The standby air compressor shall start automatically if one of the main compressor(s) fails or if the air pressure in the instrument and service air drum falls below a preset value.

If instrument air pressure drops below a preset value, service air shall be cut off.

4.5 Amendments and supplements to [ANSI/ISA-7.0.01](#)

4.5.1 Supplement to [ANSI/ISA-7.0.01](#) - Annex B - Section B.1.1.1 - Intake filters

The suction system of each compressor shall be fitted with an air filter.

The size of each air filter shall be designed for six months of continuous normal operation in the local environment conditions without replacement of the filter cartridge (maximum allowable pressure loss 50 mbar).

Air inlet shall be supplied with an AISI 316L connecting flange in case air needs to be taken from a clean and non hazardous area.

Air inlets shall be supplied with birds screen and designed to avoid rain water ingress and shall be made of AISI 316L Stainless Steel.

The air filter shall be fitted with a differential pressure gauge readable at ground level.

4.5.2 Amendments and supplements to [ANSI/ISA-7.0.01](#) - Section B.1.1.2 - Compressor

Compressor Manufacturers shall be considered on the basis of a successful proven design with associated reference list for similar sized machines operating in equivalent service conditions. References will be verified prior to any purchase.

For electric motor above 55 kW, compressors shall be designed for a maximum discharge pressure of 10 barg for water cooled design or 8 barg for air cooled type. Compressor discharge pressure of 13 barg shall be subject to Company approval.

Compressor operating discharge pressures shall be defined on the Project equipment data sheet.

Dry screw compressors are compressors that use no oil in the parts exposed to the compressed air.

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Oil-free screw compressors shall be utilized for all flow-rates up to 5000 Nm³/h subject to Supplier provision of a successful application reference list.

For flow above 5000 Nm³/h, integrally geared centrifugal compressors as per [API Std 672](#) may be proposed.

The compressor design flow shall account for the requirements of instrument and service air, and dryer regeneration and associated margin as defined in [GS EP MEC 101](#) with no negative tolerance. Design conditions shall be based at full flow, on the maximum ambient temperature, maximum ambient relative humidity and minimum inlet pressure (clogged inlet filter).

For FPSO applications, hull air compressors shall be air cooled type if they contribute to FPSO black-start capability. For all other applications, including FPSO topsides, water-cooled compressors may be proposed provided that the associated cooling water system is fed from the essential switchboard. The cooling water piping interface connections shall be manifolded within the package with single terminations at package skid edges. Cooling water outlet shall be fitted with ROV controlled by the package UCP.

Each air compressor shall be fitted with a full flow discharge valve. The Vendor shall provide and identify any further relief valves necessary for correct and safe operation included in his package and advise the valves sizing basis.

4.5.3 Supplement to [ANSI/ISA-7.0.01](#) Section B.1.1.3 - After-cooler

The air/air blast cooler radiator shall meet the requirements of the Regulations concerning pressure vessels of the country in which the air unit is to be installed. The air cooler shall be sized according to the maximum package enclosure ambient temperature. The maximum temperature of cooled air shall be 10°C above the ambient temperature.

For packages to be installed offshore or in a coastal environment, the bundles shall be made of one of these materials: AISI 316L stainless steel or higher grade, aluminum minimum ASTM grade 5000 or aluminum protected by a coating type HERESITE® from SAKAPHEN.

The fan shall be directly driven by an electric motor or by the compressor and made of corrosion proof material. Fan blades and its guard shall be made of non sparking material. Materials shall be clearly stated in technical proposal. Any piece of equipment made of aluminum shall be minimum ASTM grade 5000.

In case of water-cooled compressors and subject to the above conditions, water-cooled after-coolers may be proposed.

4.5.4 Supplement to [ANSI/ISA-7.0.01](#) - Section B.1.1.3 - Moisture separators

The moisture separators shall be located downstream of each cooler (inter-stage and after-coolers).

It shall be sized according to the maximum relative humidity of the installation site.

Inter-stage and final moisture separators shall be suitably protected against high water level.

Condensates shall be evacuated by draining system based on UCP control. Manual isolation valve and manual drain valve shall be collected and routed to the edge of the skid.

Drain valves type shall be based on proven experience on similar design, material shall be corrosion proof and approved by the Company.

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4.5.5 Amendments and supplements to [ANSI/ISA-7.0.01](#) - Section B.1.1.6 - Air treatment systems

Each unit shall include at least the following devices:

- 2 x 100% of dryer design flow pre-filters (one in service, one in standby), filtration degree: 5 µm with isolating valves and differential pressure measurement with alarm, fitted with automatic drains traps, manual isolation valve and manual drain valve collected and routed to the skid edge
- Two (2) heatless adsorption type air dryers (one in operation + one in standby mode) and associated piping and valves, each one designed for at least 1.7 times nominal flow of one compressor in 2 x 100% compressor configuration or 1.3 times nominal flow of one compressor in 3 x 50% compressor configuration
- 2 x 100% of dryer design flow after-filters (one in service, one in standby) with isolating valves and differential pressure measurement with alarm, fitted with manual drain valve collected and routed to the skid edge
- ROV downstream after-filters for remote dryers selection shall be provided
- Interconnection piping
- Instrumentation
- Isolating and depressurizing valves required for a safe maintenance.

Pressure drop across the air treatment system package limit shall not exceed 0.7 bar with clogged filters and 0.3 bar with clean and new filters.

4.5.6 Amendments and supplements to [ANSI/ISA-7.0.01](#) - Section B.1.1.6.2 - Air dryer

The air dryer shall be heatless adsorption type.

Special attention shall be given to the balancing, depressurization and pressurization phases, in particular those of the periodic regeneration cycles.

Air dryer outlets shall be fitted with silencers.

The regeneration sequence shall be fully automatic and controlled by the package control system.

The two dryer columns shall be fitted with ball valves for pipe diameter higher than 2 inches or pneumatic piston valves for smaller piping diameter. Valves shall be fitted with pneumatic actuator driven by solenoid valves.

Solenoid valves shall comply with [GS EP INS 101](#).

4.5.7 Supplement to [ANSI/ISA-7.0.01](#) - Section B.1.1.6.3 - After-filter

The after-filter shall have a filtration degree of 1 µm.

This filter shall be designed for six months of continuous normal operation without filter cartridge replacement.

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4.5.8 Amendment to [ANSI/ISA-7.0.01](#) - Figure B.1 - Compressed air drying system: desiccant dryer

The by-pass line is not required since the system is designed with 2x100% air treatment.

4.6 Coupling and coupling guards

Coupling shall be equipped with structurally rigid spark-proof coupling guard.

4.7 Package configuration

Electric motor driven air compressors, air coolers, moisture separators and, if practical, air treatment system shall be installed on a common skid.

Flexible hoses are not accepted, except those which are part of compressor Manufacturer standard.

4.7.1 Number of package base plate supporting points and type

Whatever the type of supporting structure is, concrete or offshore structure, package base plate shall be multipoint rigid design with jacking bolts for leveling purpose.

Supporting shall comply with the requirements of [GS EP MEC 300](#) and [GS EP STR 103](#).

Contractor shall install and weld sole plates on all packages in accordance with the Project specifications, if any, and Supplier requirements.

The supporting structure shall be machined prior to welding the soleplates.

Refer to Appendix 3 for details.

4.7.2 Base plate construction details

Package base plate shall be multipoint rigid design with jacking bolts for leveling purpose. Package base plate design shall conform to [GS EP STR 103](#) to maintain alignment of the line shaft under all operating conditions whether normal, transient and abnormal.

Package base plate shall be designed with either:

- A non slip decking steel plate covering the top of the base plate and a drip pan and gutter all around with 2 drains points of 2" diameter minimum
- or
- Grating covering the top of the base plate and a steel plate continuously welded at the bottom of base plate recovering any oil spill and drain points of 2" diameter minimum.

All the equipment supported by the skid shall be contained within the skid projection footprint (meaning that no equipment overhung/projection outside the skid footprint is allowed).

4.7.3 Baseplate drains

All drains which are an interface between the Supplier and Contractor shall be routed to the skid edge and shall terminate by 2" ANSI 150 # RF flanges fitted with a blind flange.

The drains shall be routed to plant hazardous open drain by the Contractor.

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4.7.4 Package lifting appliances

Package lifting appliances, such as lifting beams or spreader bars, slings, shackles, etc., shall be included in the Vendor scope of supply and designed, tested and certified by an approved authority in accordance with **GS EP STR 103**.

Lifting appliances shall be load tested at 125% of the safe working load and certified.

Visual inspections and NDT (dye penetrant and ultra sonic inspections) shall be performed after the load test.

4.8 Enclosure

An acoustic enclosure shall be provided to comply with the specified environment conditions and noise requirements. For offshore and coastal environment, the enclosure shall be made of AISI 316L stainless steel.

When internal perforated liners are required to maintain acoustic insulation, these liners shall be made of AISI 316L stainless steel.

The enclosure shall include side doors and removable panels to allow equipment maintenance and removal.

Hinges, rod assemblies and door handles shall be of heavy duty type made of AISI 316L stainless steel.

4.8.1 Air process intake/air ventilation system

When air compressor packages are installed in hazardous or restricted area, the Contractor shall source the air process and the inlet ventilation ducting for fresh air intakes to enclosure with following main features:

- Fresh air intakes to enclosure shall be located in a safe area, at least 2 meters away from a hazardous area
- The location of the air filter intake shall not be less than 2 meters above local ground level to prevent from ingress of swirling dust, insects etc.
- The complete air ventilation ducting and housing shall be made of AISI 316L stainless steel
- The air inlet ventilation ducting shall be equipped with cleanable and barrier type filters
- Air ventilation inlet shall be protected from water ingress, such as provided with weather louvers and water demister
- Enclosure ventilation air outlet shall be located 5 meters at least from any machinery combustion air exhaust termination.

When freezing is likely to occur, adequate provision shall be made to prevent from ice formation.

4.8.2 Lighting

The lighting inside enclosed areas, such as package enclosure, shall be designed for routine maintenance and inspection. It shall be permanent and supplied from the essential switchboard.

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4.8.3 Gas detectors

When air compressor packages are installed in hazardous or restricted area, flammable gas detection system at any air process intake, ventilation air inlet shall be excluded of the scope of the Supplier and included in the scope of the Contractor.

Necessary support within battery limit shall be part of Supplier scope.

Air process intake and ventilation air inlet shall be fitted each with three gas detectors.

4.9 Electrical

The design, manufacture, inspection and testing of electrical equipment provided with the packaged unit shall comply with **GS EP ELE 011**.

4.10 Piping, valves and pressure vessels

The fabrication, inspection and shipment of pipes, fittings and flanges shall comply with Company **GS EP PVV 143**, **GS EP PVV 144** and **GS EP PVV 145**.

Air system piping shall be in AISI 316L minimum.

Package limit flanges shall be in accordance with **GS EP PVV 112** or Project piping classes (if any).

Air receivers (when included in the Vendor scope) shall be designed, manufactured and inspected as per **GS EP PVV 211**. This requirement does not apply to air dryers, pre and post filters.

All main piping systems shall have low point drains.

These drains shall terminate with an isolating valve plugged.

All interconnecting piping at skid edge shall be identified and tagged.

Any required cleaning of piping systems and/or vessels at Vendor's facilities shall comply with **GS EP PVV 175**.

The standardization of size system (metric or imperial) and Manufacturer of instrument tubing and fittings shall be finalized and standardized prior to Contractor award.

4.11 Installation

The package shall be installed as per **GS EP MEC 292** requirements.

For packages to be installed on a floating structure, Vendor shall indicate the special devices installed to cope with the FPSO motions and accelerations indicated in the paragraph 6 of this specification. In any case, Vendor shall clearly indicate his layout requirements to ensure proper operation of the lube oil system and the drain system.

Vendor scope of supply shall include a vibration study according to and if required by **GS EP MEC 300**.

4.12 Instrumentation

The package instrumentation shall comply with **GS EP INS 101**, **GS EP INS 102**, **GS EP INS 107** and **GS EP INS 110**.

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Supplier shall provide with its technical proposal a preliminary set of vibration and temperature P&ID and interconnecting diagram.

Junction boxes shall be mounted at 1.6 m above grating.

4.12.1 General

The air compressor and air dryer packages are categorized as “P3 type Package”.

- All instruments shall be installed and terminated up to junction boxes or local gauge boards or to unit control panel at the skid edge
- Interconnecting junction boxes shall be provided with cable gland plates and associated cable glands
- Segregation of signals between LV, control, digital and analog cables terminals shall be done as per **GS EP INS 110** requirements.

4.12.2 Instrumentation

At least the following instruments shall be installed:

Unit component	Required instrument	Instrument action	Transmission to installation control system (ICSS)
Air inlet filter differential pressure	PDIT	Alarm	
Compressor Lube oil pressure	PIT	Shutdown of the unit	Yes
Compressor Lube oil Temperature	TIT	Shutdown of the unit	Yes
Compressor air discharge temperature LP	TIT	Shutdown of the unit	Yes
Compressor air discharge temperature HP	TIT	Shutdown of the unit	Yes
Compressor air discharge pressure LP	PIT	Alarm	
Compressor air discharge temperature LP after cooler	TIT	Shutdown of the unit	Yes
Compressor air discharge temperature HP after cooler	TIT	Shutdown of the unit	Yes
Compressor air discharge pressure	PIT	Shutdown of the unit	Yes
Compressor control pressure	PCV		
Inter stage Moisture separator drain level	LSHH	Shutdown of the unit	Yes

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Unit component	Required instrument	Instrument action	Transmission to installation control system (ICSS)
Final Moisture separator drain level	LSHH	Shutdown of the unit	Yes
Inter stage relief valve	PSV		
Compressor outlet relief valve	PSV		
Air Dyer Skid			
Pre-filter differential pressure	PDIT1 & PDIT2	Alarm	
Air Inlet Temperature upstream air dryer	TIT	Shutdown of the unit	Yes
Air Inlet Pressure upstream air dryer	PIT	Start dryer cycle @ 4 barg	Yes
After-filter differential pressure	PDIT1 & PDIT2	Alarm	
Air Dryer relief valves	PSV		
Air outlet downstream of after-filter	Connection for moisture/ dew point analyzer		

4.12.3 Vibration sensors

For rating power higher than 500 kW, each compressor bloc stage and the gear shall be fitted with one (1) accelerometer.

Additionally, for rating power higher than 500 kW, electric motor shall also be fitted with one (1) accelerometer per bearing.

4.12.4 Unit Control Panel

Each package unit shall be supplied with its dedicated UCP compliant with **GS EP INS 110** and **GS EP INS 135** requirements.

Interconnecting cables between UCP and skid, and in between UCP and ICSS/MCC will be supplied and installed by Contractor. Package Vendor shall adapt the number of terminals in marshalling cabinets and junction boxes to the type of multi-core cables in accordance with Contractor specifications. All spare wires shall be earthed through individual terminals, bonding is not permitted.

4.12.4.1 HMI

The HMI shall gather together all information coming from each PLC. The HMI shows on screen the whole network air compressors system including but not limited to lube oil, compressor load/ unload status, running/ stopped status, dryers sequences. A special screen shall be dedicated to alarms and trips for each system. Records historic page of all alarms and trips is expected.

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4.12.4.2 Communication

The communication with ICSS shall be carried out through redundant Modbus System. Trip signals from/ to the ICSS are hard wired.

Signals from any on package skid instrument required by the control system shall be wired up to dedicated boxes located at the package skid edges.

4.12.5 Control philosophy

Three running modes are considered:

- Remote
- Automatic local
- Local.

4.12.5.1 Remote mode

The air compressor system shall be normally controlled by its UCP and operated from the ICSS Operator workstation. The remote mode is the normal running mode.

Start/Stop orders are coming from the ICSS. Compressors priority and regulation are managed by the ICSS in which case commands on UCP are not available.

4.12.5.2 Automatic local mode

In case of communication failure with ICSS, this mode shall take over controls through signal from PT installed on each compressor discharge. The air compressors sequences are managed by the HMI.

4.12.5.3 Local mode

Local mode is possible subject to:

- The local selector installed on UCP panel and the ICSS switch are both on "local mode"
- The air compressor will be started and stopped from the local gauge panel located on the air compressor skid.

Whatever the running mode selected, all safety functions are managed by the UCP.

4.12.6 Local gauge panel

Units shall be equipped with a local on-skid control panel suitably accessible and visible and comprising the following:

- Emergency shutdown push button
- Local start push button (green)
- Local stop push button (red)
- "Default" annunciator
- "Running" annunciator

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- Lube oil pressure gauge
- Air compressor discharge temperature gauge
- Air compressor discharge pressure gauge.

This local panel shall be connected to the air compressor UCP.

4.13 Painting

Package unit shall be painted according to **GS EP COR 350** or **GS EP COR 354** according to site environment.

For packages to be operated offshore or in coastal environment:

- Package skids and support structures, piping and pressure vessels within the scope of supply shall be painted according to **GS EP COR 350** system P01
- When required by **GS EP COR 350**, paragraph 3.2, components made of Stainless steel shall be painted according to **GS EP COR 350**, paragraph 3.2
- Rotating machines shall be painted according to Supplier standard suitable for offshore environment, if approved by Company, or according to **GS EP COR 350** system P14.

4.14 Heal Safety and Environment

4.14.1 Hot surfaces

Any hot surface that can be reached by Operators shall be insulated in such a way that their maximum skin temperature be lower than 70°C.

4.14.2 Noise requirements

All definitions, notations, testing methods calculation methods and calculation procedures shall be in accordance with **GS EP MEC 300**.

All efforts shall be deployed to limit the average sound pressure level around the package at following values:

- Equipment within an enclosure: 85 dB(A) at one meter
- Equipment without enclosure: 90 dB(A) at one meter.

Supplier shall submit during Tender the expected noise map at one meter of the sound pressure levels in dBa per octave bands, and the maximum sound power level.

4.15 Miscellaneous

4.15.1 Dew point analyzer

The Vendor shall quote as an option the provision of a dew point analyzer providing details and proven experience references. The analyzer shall be located in the Unit Control Panel and linked to ICSS. The moisture probe shall be installed at common outlet of the skid package.

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4.15.2 Air receivers

Air receivers shall be designed according to pressure vessels Project specifications and fitted with draining facilities.

The internal part shall be coated with a corrosion resistant system.

A by-pass is required from inlet to outlet to allow vessel maintenance.

4.15.3 Bolting

Package bolting shall be as follows:

- For diameter above 24 mm, bolting shall be according to **GS EP COR 356** paragraph 6
- For diameter up to and including 24 mm, bolting shall be of AISI 321 Stainless steel as a minimum.

4.15.4 Name plate's tags and labels

All major equipment shall be identified by AISI 316L Stainless Steel nameplates attached by AISI 316L Stainless Steel pins or screws. All operating notices, warning notices and nameplates shall be in the English and language and as indicated in Project documents.

4.15.5 Rotation arrows

Direction of rotation arrows shall be clearly and permanently marked on all rotating equipment.

4.15.6 Maintainability and accessibility

For all items within the package, Vendor shall comply with the following requirements:

- Accessibility for operation (position of instruments, legibility of readouts, operation of valves, etc.) and for maintenance. If necessary, an access platform with stairs or ladder shall be provided for equipment that cannot be accessible from the ground.
- Removable gratings or plates shall be provided around the machines to allow access and to protect equipment located in the bottom part of the package.
- Maintainability (disassembly, reassembly, adjustment) with the necessary space and handling devices as appropriate to bring any piece of equipment to dedicated lay down areas.
- Safety instructions.

All the above requirements shall be fully supported by an engineering handling study during Contract execution, for the following components but not limited to: driver, rotors, couplings, electric motors, gears, piping spools, etc.

A design review of the package accessibility and maintainability shall be organized with Company and Contractor prior to package construction. This review shall be supported by Vendor 3D CAD models.

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For equipment over 20 kg, jack screws, lifting lugs, eyebolts or equivalent shall be provided to perform alignment, disassembly and re-assembly. Equipment/driver alignment must include a minimum of:

- 20 mm AISI 316 stainless steel machined shims
- 3 mm AISI 316 stainless steel final adjustment shims.

These shims are part of the Vendor scope of supply.

4.15.7 Inspections

The inspections shall be conducted according to the Project ITP. As a minimum, the requirements reported in Appendix 5 shall apply. The weight control shall be performed as per **GS EP STR 001**.

4.15.8 Engineering documentation language and units

The engineering documentation shall be developed as follows:

Language: English and

Units:

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Reference / Revision: /

5.2 Electric motor

Reference / Revision: /

5.3 Noise

Reference / Revision: /

5.4 Weight

Reference / Revision: /

5.5 Data sheets templates

Each data sheet requested in the VDR enclosed in the Appendix 4 of this specification shall be filled in by the Vendor in the Company template format.

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6. Site conditions and utilities

6.1 Site conditions

LOCATION

ALTITUDE

CLIMATE

ATMOSPHERIC PRESSURE

Average		mbar
Minimum		mbar
Maximum		mbar

AMBIENT TEMPERATURE

Design (minimum / maximum)		°C
Normal		°C
Minimum		°C
Maximum		°C

WIND

Normal		m/s
Design		m/s
Direction		

RELATIVE HUMIDITY

Minimum		%
Maximum		%

ENVIRONMENT

Dust	
Smoke	
Other	

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BLAST

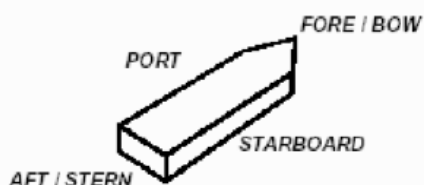
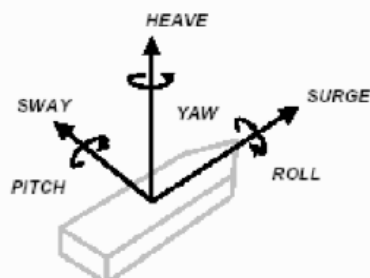
Equivalent static pressure (mbar)

CLASSIFICATION TYPE AREA
OPERATIONAL DESIGN CONDITIONS

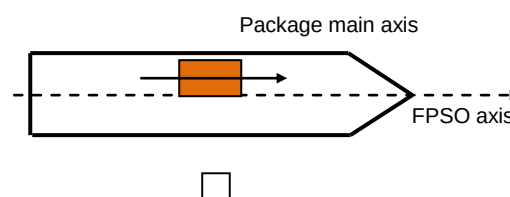
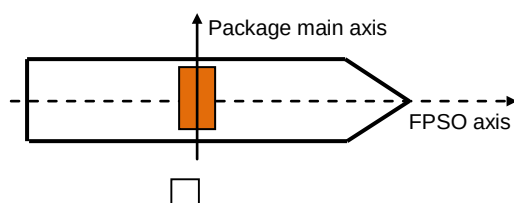
Project Phase:	During towing	On site	On site	
Condition:	Dry	Operating	Damaged	
Longitudinal acceleration (Surge)				m/s ²
Transversal acceleration (Sway)				m/s ²
Vertical acceleration (Heave)				m/s ²
Trim angle (Pitch)				°
List angle (Roll)				°

The motions and accelerations are given in the following way (typical):

Surge	X	Roll / List	Rotation / X
Sway	Y	Pitch / Trim	Rotation / Y
Heave	Z	Yaw	Rotation / Z


FPSO Orientation

FPSO Movement definition
TECHNICAL ROOM ENVIRONMENTAL CONDITIONS

The environmental conditions of technical room in which the UCP will be installed are specified in the document revision .

PACKAGE ORIENTATION ON FPSO


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6.2 Utilities

ELECTRICITY

Refer to:

- Project specification for electrical requirements for packaged units:

rev

- **GS EP ELE 011**

UCP UPS Earthing Regime:

UCP Normal Power Regime:

COOLING WATER SYSTEM

Type	Sea Water	Fresh Water	
Normal inlet temperature			°C
Minimum inlet temperature			°C
Maximum inlet temperature			°C
Minimum outlet temperature			°C
Maximum outlet temperature			°C
Supply pressure			Barg
Max allowable delta P			Bar
Calorific capacity			kJ/kg°C
Fouling factor			m ² .°C.h/kcal

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7. Tests

7.1 Factory tests (workshop)

The scope of this chapter is to describe the factory tests to be carried on the completely assembled air compressor and air dryer packages in Vendor facilities before unit shipment.

Factory tests shall demonstrate the correct design, manufacture and operation of the equipment and its satisfactory performance in accordance with the conditions identified in the mechanical data sheet. Works testing shall include a combined compressor package/dryer factory test to demonstrate compliance of the complete package with mechanical data sheet and specified performance requirements.

The following tests shall be carried on the completely assembled package:

- Performance testing of individual equipment item (electric motor, compressor, dryers)
- Pre-test activities
- Performance and mechanical running test of air compressor and air dryer packages. This activity shall include the functional test of all the main auxiliary systems of the package
- Assembled package shall be weighted before packing and shipment.

The following documentation shall be issued by Supplier prior the factory tests in workshop:

- Issue of the factory test procedures
- Issue "As built" drawings relevant to factory test,

The test procedure shall be issued 8 weeks prior the test (including noise and vibration measurement proposed procedure).

The results of each test shall be recorded in appropriate log sheets provided by Vendor and signed as "witnessed" by all the parties.

After the completion of the tests, Vendor shall issue an official test report including all the above log sheets. Copy of raw data registered during the tests shall be handed over right after each test activity for Contractor inspection record.

All tests identified as factory tests will be witnessed by Company or their representative.

7.1.1 Performance test

Performance testing of individual equipment items:

- Performance test of air dryers
- Electric motor routine test
- Performance test of each air compressor at 100% load.

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7.1.2 Pre-test activities

Before commencing the factory testing of the completely assembled packages, the following minimum pre-test activities shall be carried out:

- Checking the compliance of the equipment with the Project specifications
- Weights and dimensional checks before packing
- Checking the certificates of compliance for the hazardous area components
- Calibration of all Project instruments. Relevant calibration certificates shall be available at the time of the test for Contractor review. Spot checks of instruments calibration shall be required before test commencing
- Instrumentation and electrical equipment insulation and continuity tests
- All instrumentation and electrical equipment functions shall be verified, including simulation, shut-downs and remote signals
- Control loops checks and functional test
- Instruments, controls, alarms and safety devices
- Safety and protection devices operational checks
- Serial link test
- Equipment tagging and labeling checks
- Mechanical equipment alignment check
- Pneumatic pressure tested piping system with compressed air or nitrogen
- Leakage tests with air compressed at max operational pressure
- Lube oil flushing and cleanliness
- Verification of the dynamic stiffness of the test bench as per **GS EP MEC 300**.

The reports relevant to the mechanical equipment alignment check and to flushing and cleanliness checks shall be available for Contractor review during test when applicable.

Before commencing the tests the package shall be cleaned by Vendor and shall be visually inspected by Contractor.

7.1.3 Performance and mechanical running tests

Supplier shall provide all temporary equipment required for implementation of the tests, including, but not limited to temporary connections, hardware to simulate signals and interfaces external to the supplied equipment etc.

Supplier shall be responsible, as well for providing all utility services needed to perform the test in proper conditions.

The complete unit test, four (4) hours uninterrupted continuous duration, shall be carried out on units fully erected, commissioned and shall involve all Contract equipment listed in the scope of supply.

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The complete unit test shall consist of two (2) x 100% or three (3) x 50% compressors and two (2) x 100% dryers connected together.

When three (3) x 50% configuration, two (2) x 50% compressors, at a time, and one (1) x 100% dryer shall be run together for four (4) hours each.

The compressors shall be operated at the rated point, and the flow from the each compressor and each one dryer, shall be verified to be at the guarantee conditions specified on the mechanical data sheets.

The complete unit test shall consist of:

- Performance and mechanical test of compressors with Contract electric motors, Contract air dryers, all Contract auxiliaries items, Contract UCP and associated instrumentation
- Flow shall be verified by means of flow transmitter and orifice plate, flange type according to [ISO 5167](#)
- Instrument air analysis in accordance with the guidelines of [ANSI/ISA-7.0.01](#) - Annex C - Section C.3 - Tests. The Dew point shall be monitored
- Emergency trips such as but not limited to manual stop, low lube oil temperature, etc.
- Operational checks such as but not limited to start/stop normal sequences, emergency stop sequences, etc.
- Noise measurements shall be performed when unit is at full load as per [GS EP MEC 300](#)
- Vibration record.

Vibration shall be measured during the shop test of the assembled machine operating over the agreed speed range. Acceptance limits shall be as per [ISO 10816-3](#). Contract vibration monitoring equipment shall be used.

All running parameters shall be recorded every thirty minutes.

Each test shall be subject to a test report issued by Supplier and submitted to Company and Contractor.

7.1.4 Communication link test

Factory test shall also include PLC communication tests with Contractor supplied control system.

Contract UCP shall be 100% checked and tested, including all input/output simulations and all logic and sequences at the control panel Manufacturer's premises prior to dispatch the equipment to the unit assembling location.



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7.2 Site acceptance tests

Site acceptance of the unit will be pronounced only after the satisfactory completion of the field acceptance tests.

Such tests shall demonstrate that the air compressor and air dryer package meet the mechanical and performance requirements within the specified operating range and conditions.

This test shall be carried out on the site or at integration yard, in operating conditions, with the air compressor and air dryer packages connected to the distribution network.

8. Spare parts and special tools

This paragraph gives guidelines to set the choice of spare parts and special tools for this project. It shall be read in conjunction with **GS EP EXP 217**.

8.1 Spare parts

8.1.1 Commissioning and start-up spare parts

As a minimum, Vendor shall supply the following spare parts:

Compressor:

- Pre-filters
- Air filters elements
- Compressor oil filters
- Solenoid valves
- Gaskets.

Programmable Logic Controller (PLC):

- Power cards
- Digital input/output cards
- Analog input cards
- Fuses, lamps, relays.

Dryer skid:

- Pre-filters
- Post-filters.

8.1.2 Capital or insurance spare parts

The Vendor shall quote the following:

- A spare compressor set (complete LP and HP rotor and casing) fully tested as identified as per paragraph 7 of this specification
- Complete LP and HP pinions
- One set of gearbox bearings
- Bull gear.

8.2 Special tools

Where special tools and fixtures are required to disassemble, assemble or maintain the packages, they shall be identified, listed and included in the Supplier quotation and furnished as part of the initial supply of the package.

Installation kit for spare LP and HP compressors is required as a minimum.

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9. Preparation for shipment

The purpose of the preservation and shipment requirement is to assure the best economical protection against adverse atmospheric weather, corrosion build up and mechanical damage due to storage and transportation from Vendor (Manufacturers, Packagers and Contractors) premises to Contractor yards and from Contractor yards to Company site.

The Vendor and/or Manufacturer shall issue necessary procedures which shall be applied to any equipment to cover:

- The preservation during workshop storage
- The preservation, packing and fastening of equipment during transportation from Vendor facilities to Contractor yard construction
- The preservation during the construction works on the Contractor yard
- The preservation, packing and fastening of equipment during towing from Construction yard to Company site.

The procedures shall contain a check list including all preservation and packing tasks.

The hereafter requirements shall also be applied to the capital spares delivered with the Contract. The capital spares shall always be preserved and packed for long term outside storage.

9.1 Preservation

The preservation duration will be selected by the Project in the package data sheet and/or equipment data sheets.

Two types of preservation can be applied depending on Project needs: short term preservation or long term preservation.

The considered preservation shall be valid for shipment between:

- Vendor workshop and Contractor yard
- Contractor yard and site.

The short term preservation shall cover a period up to six (6) consecutive months after processing of the preservation. The considered storage shall be outside without protection.

The long term preservation shall cover a period up to twelve (12) consecutive months and be annually renewable during five (5) years.

The desiccant products shall be free of DMF (dimethyl fumarate) content and shall be selected from Silica base. The regeneration of desiccant products is a mandatory requirement and shall be done by heating.

The desiccant products shall conform to [NF H00-320](#) or [DIN 55473](#) or [US MIL D 3464E](#) standards.

The VCI (Volatile Corrosion Inhibitor) and VPI (Vapor Phase Inhibitor) shall conform to the norm [US MIL-STD-2073-1 E](#). However necessary care shall be taken to use approved products compatible with the materials needing to be preserved.

All desiccant products locations shall be provided with a metallic label indicating their presence.

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The last mechanical and/or performance runs can be done with anti-corrosion additives mixed with the lube oil. However Vendor shall demonstrate that the anti-corrosion additives shall not compromise the life of the equipment.

All opening shall be closed with metallic blind and gasket to be air and water sealed.

Metallic labels with necessary cautions and instruction to remove preservative products prior equipment start-up shall be provided.

The labels shall be made of metal with black marking on yellow back ground.

9.1.1 Compressor

After completion of the tests, compressor Manufacturer standard preservation shall be applied following the below tasks, not limited to:

- Draining
- Drying
- Cleaning
- Insertion of desiccant product where necessary
- Sealing of openings with metallic blinds.

9.1.2 Instrumentation and electrical auxiliaries

- Draining
- Drying
- Insertion of soft bags desiccant products in instrument junction boxes and in instrument head
- Sealing of openings.

9.1.3 Control panels

- Draining, where needed
- Drying
- Cleaning of panels
- Packing of all equipments not rack mounted
- Insertion of soft bags desiccant product inside the control panel
- Positive locking of all doors
- Sealing of openings.

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9.1.4 Auxiliaries

The package auxiliaries generally include piping, filters, heat exchangers, valves, ducting, structural frames.

- Draining
- Drying
- Cleaning
- Spraying, if any, of Tectyl™ or VCI
- Spraying Water resistant wax Tectyl™ and wrapping on all non painted interfaces
- Sealing of opening.

9.2 Packing

9.2.1 Weather protection

The design of the packing shall procure an optimal weather protection during oversea transportation and Contractor yard storage.

During the detail engineering phase, Contractor, in conjunction with Vendor, has to issue and submit the preservation and sea fastening procedures to Company representative for approval.

Contractor shall be fully responsible of equipment preservation until provisional acceptance on site.

The weather protection shall be made of heat welded multilayer film (polyester, aluminum, polyethylene) and shall be installed around the package. All lifting appliances and lifting points shall be provided outside the weather protection and shall not be subject to losses of sealing. The film shall conform to [NF H00-310](#) or [US MIL PRF 131K](#) standards.

Prior to weld and seal the multilayer film, the hereafter sequences shall be applied, but are not limited to:

- A sweeping with Nitrogen shall be performed in order to remove the internal moisture as much as possible to get low residual humidity
- A set of desiccant bags shall be included to absorb residual moisture and trap during transportation and storage the moisture passing through the multilayer film envelope
- A moisture indicator (sensitive paper) shall be included inside the envelope prior sealing to perform the traceability of the internal atmosphere during transport and storage.

9.2.2 Mechanical and infestation protection

The mechanical and infestation protection shall be performed by a use of multilayer wooden plates (plywood).

The multilayer wooden plates shall be sea water resistant in case of overseas transportation. A selection of multilayer wooden plates in accordance with marine immersion resistant, french standard CTBX or equal classification requirements is required.

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The construction of the overall mechanical protection shall be done in such a way that internal or external members shall not damage the weather protection.

The construction shall be in such a way that rodents and insects cannot enter inside the box.

9.2.3 Fastening

All devices needed for the fastening, whatever the transportation mode considered (sea, onshore, rails, dirty and/or ice roads), shall be provided external to the mechanical protection. The fastening shall not affect the weather/mechanical protection integrity.

The fastening shall be part of the equipment design engineering phase and shall be provided to avoid any modification and/or welding on the equipment during its installation until completion.

9.2.4 Marking

The minimal requirements for marking shall conform to the [ISO 780](#) code in addition to the specific requirement of the Project.

9.2.5 Compressor specific

The compressor shall be preserved as per clause 9.1.1 and packed as per clause 9.2 during transportation from Vendor facilities to Contractor yard and from Contractor yard to Company site.

All sensitive parts like antifriction bearing, rotor shaft, shall be locked in place and insulated by means of shock absorber. The rotor locking devices shall be labeled with metallic instructions and cautions label with black making on yellow colored back ground labels shall be provided.

The locking devices shall be supplied by the Vendor.

For capital spares, internal or external vibrations and shocks absorbers and shock loggers shall be provided. Drop acceleration limit shall be indicated by the Supplier.

9.2.6 Loose shipped items and auxiliaries

The loose shipped items delivered with the Contract (including commissioning, start-up and capital spare parts) shall be preserved as per clause 9.1 and shall be packed inside a VCI plastic bags as per clause 9.2.1 and clause 9.2.2 during transportation from Vendor facilities to Contractor yard and from Contractor yard to Company site.

The packing boxes shall be provided with:

- Internal or external vibrations and shocks absorbers.
- External lifting and handling devices and fastening provisions
- External marking in accordance with [ISO 780](#) and Project specific requirements
- Internal harness and/or means for fastening
- Moisture indicator
- Internal or external provision for documentation storage
- External blank marking area and/or location to attached the AWB (Air Way Bill).



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9.3 Transportation

The Notified body responsible for transportation between Vendor facilities and port of shipment shall perform the assessment of the means, risks and constraints.

It shall be clearly specified in the Vendor proposal the means to be used for transportation, the loading of the equipments and the induced constraints due to sea, road, rails transportation in terms of equipment assembly and number of packs.

A preliminary packing list including packing dimensions and weight table shall be attached to the Vendor proposal to give possibility to Company to assess the transportation impacts prior Contract award.

The handling, loading and unloading procedures and the lifting drawings shall be part of the engineering phase and shall be developed by the Vendor.

The spreader bars, the lifting beams and ancillaries (slings, shackles) shall be supplied by Vendor and shall be load tested and certified by third party notified body. The use of synthetic slings is not allowed.

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Date:**Appendix 1****Appendix 1 Definitions and abbreviations**

Company	Total E&P or any Total E&P subsidiary
Contractor	Any Company Total E&P has signed a Contract with for the Engineering, Procurement, Construction and Installation of a part of a project
DMF	Dimethyl Fumarate
HMI	Human Machine Interface
ICSS	Integrated Control Safety system
ITP	Inspection Test Plan
MCC	Motor Control Center
NDT	Non Destructive Test
OEM	Original Equipment Manufacturer
Package	Prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation
PLC	Programmable Logic Controller
SAT	Site Acceptance Test
SPL	Spare Parts List
Supplier or Vendor	The package Supplier or Vendor
UCP	Unit Control Panel
VCI	Volatile Corrosion Inhibitor
VPI	Vapor Phase Inhibitor
VTMS	Vibration & Temperature Monitoring System

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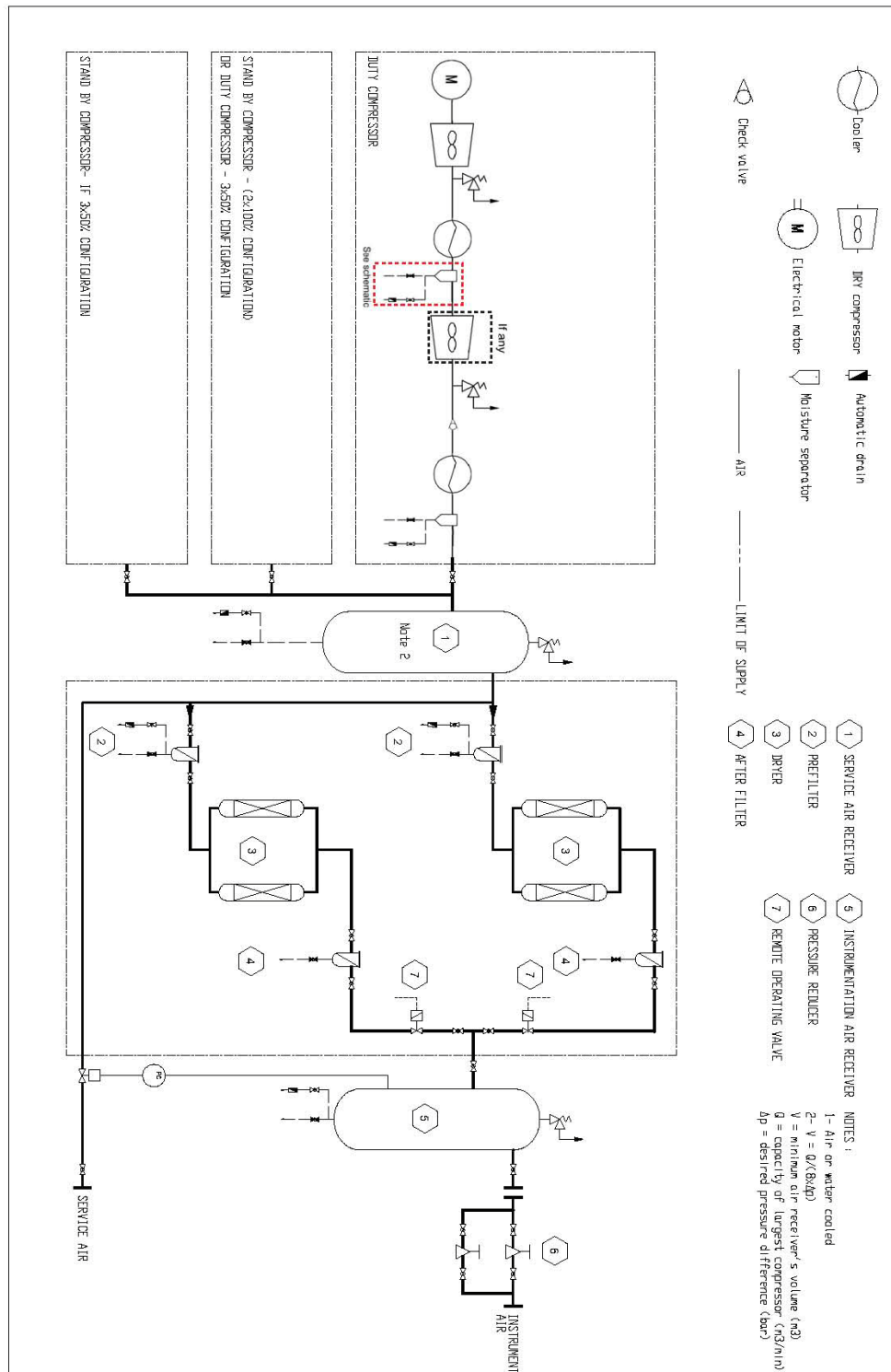
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Appendix 2
Appendix 2 Package schematic


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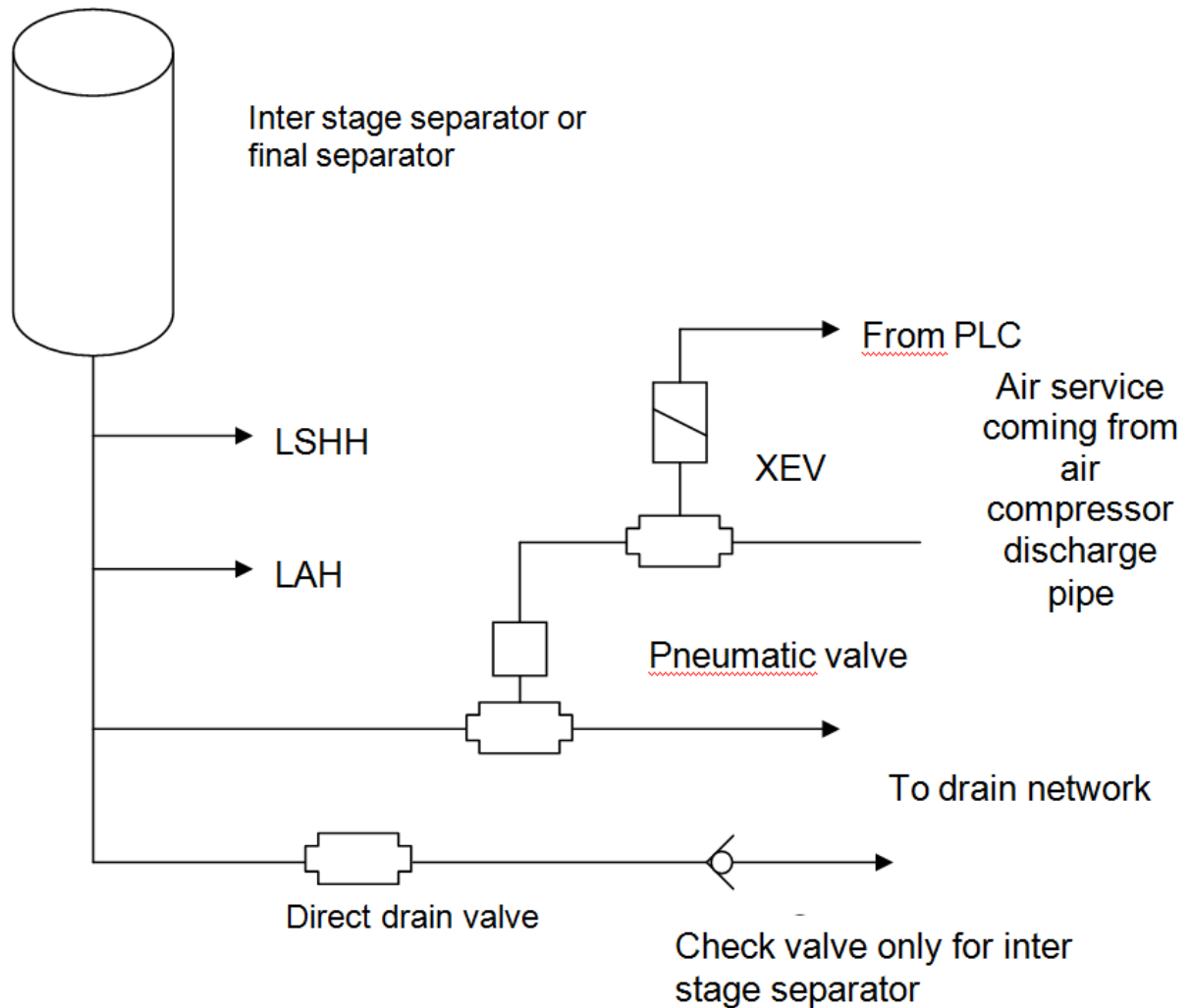
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Appendix 2

Schematic for drain level control



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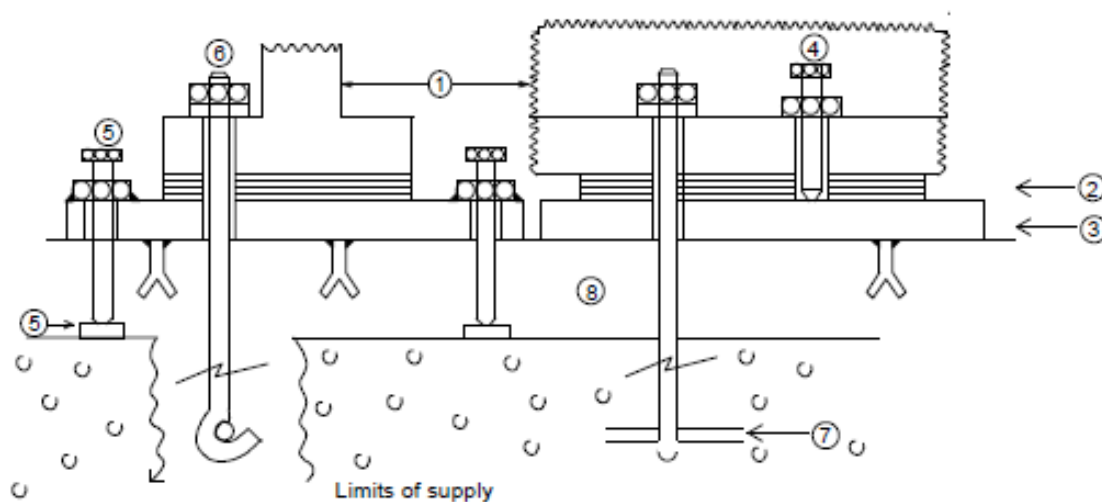
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Appendix 3

Appendix 3 Baseplate installation

CONCRETE FOUNDATION

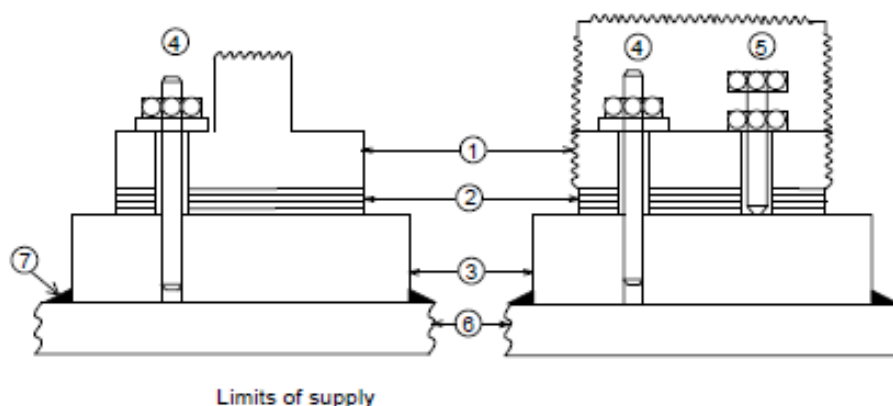

SUPPLIER

- ① Base plate
- ② Shims (20 mm min)
- ③ Sole plate (30 mm min)
- ④ Base plate levelling screws
- ⑤ Soleplate levelling screws
- ⑥ Anchor bolts
- ⑦ Anchor bars

CONTRACTOR

- ⑧ Non shrinking epoxy grout

STEEL STRUCTURE FOUNDATION


SUPPLIER

- ① Baseplate or Gimbals or AVM
- ② Shims (20 mm min)
- ③ Soleplate (50 mm min)
- ④ Anchor bolts
- ⑤ Levelling screws

CONTRACTOR

- ⑧ Deck
- ⑦ Welding

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Appendix 4 Vendor Document Register (VDR)

The following documents shall be delivered by the Package Vendor. This list is a mandatory base frame but might be extended on a Project basis.

(1) Documents to be supplied with offer.

Item	Designation	(1)
1	General	
1.1	Vendor document register	X
1.2	Deviation list	X
1.3	Monthly report	
1.4	Sub-Vendors List	X
1.5	Quality Plan	
1.6	Inspection and Test Plan	X
1.7	Declaration of conformity for ATEX	
2	Arrangements	
2.1	General Arrangement drawing for Air compressor and Air dryer Packages	X
2.2	Foundation Drawings	
2.3	Limits of supply table (interface and connection schedule)	X
2.4	Allowable nozzles loads	
2.5	Lifting Drawing	
2.6	Unit Control Panel	X
3	Data sheets	
3.1	Air compressor data sheet	X
3.2	Air dryer data sheet	X
3.3	Heat Exchanger Data sheet	
3.4	Electric motor data sheet	X
3.5	Noise data sheet	
3.6	Weight data sheet	
3.7	Maintenance data sheet	
3.8	Instruments data sheet	
3.9	Other data sheets (LV motors, valves, lube oil filters etc.)	
4	P&IDs & Lists	
4.1	P&ID symbols table	
4.2	PFD and PID's	X
4.3	Equipment list / Bill of materials	X
4.4	Load and Utilities List	X
4.5	Lubrication list and schedule	

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Item	Designation	(1)
5	Detail drawings	
5.1	Compressor Outline drawing	
5.2	Compressor sectional drawing and associated part list	
5.3	Outline drawings (moisture separators, coupling, heat exchangers, pre-filters, ROV, PSV...)	
5.4	Electric motor Outline drawing	
5.5	Electric motor sectional drawing and associated part list	
5.6	Electric motor terminal box Outline	
5.7	Local gauge Outline	
5.8	Dew point analyzer Outline	
5.9	Wet/ Dry air receivers drawing	
5.10	Equipment data plate drawing	
5.11	Isometrics of lines	
5.12	Piping Classes	X
6	Instrumentation and Controls	
6.1	Junction Boxes dimension and termination diagram	
6.2	Control philosophy and Functional analysis	
6.3	Instruments hook up Diagrams	
6.4	Instruments list	
6.5	HMI displays	
6.6	PLC software	
6.7	Instruments and electrical cables list	
6.8	Modbus list including addressing	
6.9	I/O list	
6.10	Instrument index S4I format	
6.11	Alarm / shut down list	
6.12	Interconnecting diagram (instrumentation and electrical)	
6.13	Earthing diagram	
6.14	Logic diagrams	
6.15	Cause and effect chart	
6.16	Instrument loop diagrams	
6.17	UCP terminal strips	
6.18	Junction boxes terminal strips	
6.19	Wiring diagrams	
6.20	Obsolescence dossier	
7	Calculations & Performances data	
7.1	Process performance calculation air dryer	
7.2	Lateral analysis calculation note	
7.3	Baseplate calculation note	

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Item	Designation	(1)
7.4	Safety relief valve calculation	
7.5	Other calculation notes (valves, actuators, flow transmitters, etc.)	
7.6	Pressure vessel code calculation for dryer/vessel	
8	Manuals/ procedures/ other lists	
8.1	Painting specification	
8.2	Installation and operating manual index	
8.3	Installation and operating manual	
8.4	Special tools list	
8.5	Start up and commissioning spare parts list	X
8.6	Priced operating spare parts list	
8.7	Capital spare parts list	X
8.8	Packing index and packing list	
8.9	Storage prior and after erection procedure	
8.10	Weighing procedure	
8.11	Performance/ mechanical running test procedure	
8.12	UCP test procedure	
8.13	Factory test for complete package procedure	
8.14	SAT procedure	
8.15	Reports for the above tests (2)	
8.16	Preservation procedure	
8.17	Packing procedure	
9	Manufacturing / Quality / HSE documents	
9.1	NDE procedures	
9.2	Welding procedures	
9.3	Material certificates	
9.4	All tests and inspections certificates	
9.5	QA/ QC (Manufacturing data book) index	
9.6	QA/ QC (Manufacturing data book) Dossier	

(2) The package string test report shall include pictures of the package (four side views and four isometric views)



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Appendix 5

Appendix 5 Minimum inspection requirements

As a minimum, the following inspections shall be witnessed by the Company:

- Functional, performance and mechanical running test of all air compressors and air dryers units
- Final inspection
- Final Dossier data book review.

Note: This list does not include the inspections to be conducted by Contractor and by Third Party or Classification Company on each sub-equipment composing the package.



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Appendix 6

Appendix 6 Deviations to the contractual documents

If deviations are waived during the bid phase, they shall be listed in the following pages in the purchase revision.

The deviation list shall exhibit at least the following:

- Reference of the specification
- Paragraph of the specification
- Description of the deviation
- Reason for deviation
- Vendor proposal
- Company final position.

The deviations that are not accepted by Company shall appear in this list in order to give a complete overview of the technical discussions.

The following list contains pages.

Note: The deviation list might not be attached to this specification but referenced under a project document (as reported below).

Project document reference:

Revision

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Date:**Appendix 7****Appendix 7 Data sheet**

Data sheet DS EP MEC 033.

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Appendix 7

**FEUILLE DE DONNEES
DATA SHEET
Air compressor and Dryer**
REPERE / ITEM

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REV	PAGE

CLIENT :	
LIEU :	
LOCATION :	

rev	Item	Requirement	Proposal	Comments
	SUPPLIER			
	Offer reference			
	Instrument air quality	ISA S7.0.01 - Section 5		
	Required flow at skid outlet (2)			
	Required pressure at skid outlets			
	Regulation/standard for pressure vessels			
	Installation condition			
	Suitability for hazardous area			
	Service for the package			
	Environmental Data			
	Humidity	Maximum: % Average: %		
	Location	Outside / Unheated / Marine atmosphere / Tropicalisation / winterisation		
	Material certificates	3.1 for pressure vessels, piping. 2.2 for skid and compressor		
	AIR COMPRESSOR			
	Air intake filters	1 per compressor		
	MANUFACTURER			
	Model			
	Offshore design			
	Design flow			
	Filtration mesh			
	Cartridge design	6 months of continuous operation		
	Cartridge material	Dry cartridge		
	Filter housing	Rainproof Designed to avoid suction of rain water		
	Air suction flange	Connection with suction ducting		
	With a clogging indicator	Differential pressure gauge		
	Suction Silencer			
	Suction Ducting			
	Compressor			
	Type	Screw - Dry type		
	MANUFACTURER			
	Model			
	Discharge pressure design			
	Design flow			
	Margin for leakage			
	Nominal discharge temperature at site conditions			
	Maximum discharge temperature at site conditions			
	Casing material			
	Rotating parts material			
	Bearings type and model			
	Rotor sealing device			
	Nominal speed			
	Nominal shaft power			
	Driver	Electric motor		
	Electric motor MANUFACTURER			
	Electric motor model			
	Electric motor speed			
	Electric motor suitable for hazardous area			
	Coupling type	with non sparking guard		
	Discharge pressure control system	Pressure regulator		
	Construction code			
	Process control	ON/OFF & LOAD/UNLOAD (1) Local / Remote		
	Piping class			
	Discharge silencer			
	Safety valves			
	Check valve			
	Pressure transmitter			
	Noise enclosure	max noise level: 85 dBA @1 meter		



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DATA SHEET
Air compressor and Dryer**

REPERE // ITEM

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REV

PAGE

CLIENT :

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Item	Requirement	Proposal	Comments
Air after-cooler			
Type	Air/ air blast cooler or water cooled		
Construction code			
MANUFACTURER			
Model			
Design temperature for the air/air heat exchanger			
Design pressure for the air/air heat exchanger			
Volume of air bundle			
Material of air bundle	316L SS or higher grade Aluminum minimum ASTM grade 5000 or Carbon Steel with coating type HERESITE from SAKAPHEN		
External coating of the cooler	GS EP COR 350		
Nominal cooled air temperature at site condition			
Maximum cooled air temperature at site condition	10°C above ambient temperature		
Fan System			
Designed blast air flow	Outside / Unheated / Marine atmosphere / Tropicalisation		
Fan material	non sparking		
Fan guard material	non sparking		
Fan speed RPM			
Fan driver			
Driver speed RPM			
Fan shaft power			
Moisture separator			
Location	Downstream each cooler		
MANUFACTURER			
Model			
Volume			
Maximum working pressure			
Max working temperature			
Material			
Internal paint system			
Automatic drain system			
Manual drain system			
DRYER			
Pre-filters			
	2x100%		
MANUFACTURER			
Model/cartridge model			
Volume			
Inlet/outlet connections			
Casing material and coating			
Maximum working pressure			
Max working temperature			
Design flow			
Filter cartridge material			
Filtration mesh (microns)	5 microns		
Residual oil content after filtration	ppm by weight at site temperature		
Designed for 6 months of continuous operation			
Automatic and manual drain systems			

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DATA SHEET
Air compressor and Dryer**
REPERE / ITEM

N° A RAFFELER / Ref. Number

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REV PAGE

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rev	Item	Requirement	Proposal	Comments
	Air dryer			
	Type	Heatless adsorption		
	MANUFACTURER			
	Model			
	Adsorption material			
	Inlet temperature			
	Maximum % moisture saturation of inlet			
	Volume of one pressure vessel			
	Inlet/outlet connections			
	Vessels material and internal coating			
	Maximum working pressure			
	Minimum working pressure			
	Max. working temperature			
	Design flow	At least 1.7 nominal flow for 2x100% or 1.3 nominal flow for 3x50% configuration		
	Regeneration air flow			
	Guaranteed dew point at the outlet			
	Regeneration sequence duration (seconds)			
	Sweeping time (seconds)			
	Exhausts fitted with silencers			
	Control system			
	XV MANUFACTURER and model			
	After-filter	2x100%		
	Type	High efficiency dust filter		
	MANUFACTURER			
	Model/cartridge model			
	Volume			
	Inlet/outlet connections			
	Casing material and coating			
	Maximum working pressure			
	Max. working temperature			
	Design flow			
	Filter cartridge material			
	Filtration mesh (microns)	1 micron		
	Residual dust content after filtration	ppm by weight at site temperature		
	Designed for 6 months of continuous operation			
	With hand operated drain system			
	Pressure drop between dryer inlet and dryer outlet	xx bar with clogged filters		
	Skid			
	Common skid for compression system and air treatment system			
	Lifting lugs			
	Closed lower plane and a drain pipe brought to the limit of the skid			
	Motor driven compressors installation			
	Flexible hoses	Not accepted		
	Zinc-bichromate plated screw fasteners for diameters above 12 mm			
	Screw fasteners of smaller diameters made of 316 L stainless steel			
	Shims, counter-shims in 316L			
	Instrumentation	As per GS EP MEC 033 §4.12.2 as a minimum		
	Air inlet filter	PDIT		
	Screw compressors (air/ lube oil)	Discharge pressure regulator PCV Control pressure Discharge temperature transmitters		
	Cooler			
	Downstream moisture separator	LSHH		
	Pre-filter	PDIT		
	Upstream line of the dryer	TIT		
	Air dryer	TIT, PIT, PDIT		
	After-filter	PSV		
	Air line downstream after filter	Connection for moisture analyzer		
	Control monitoring system	P3 package		
	UCP MANUFACTURER and model			

